09572510 "0250h00

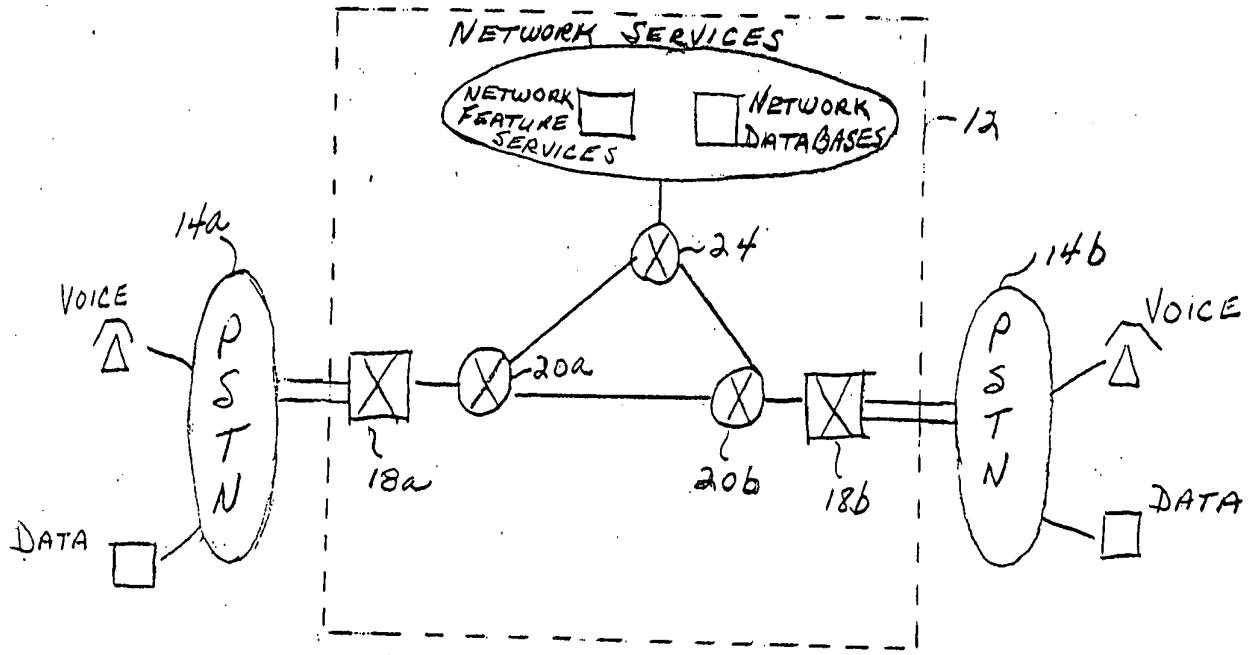

FIG. 1

09577515 "05250h00

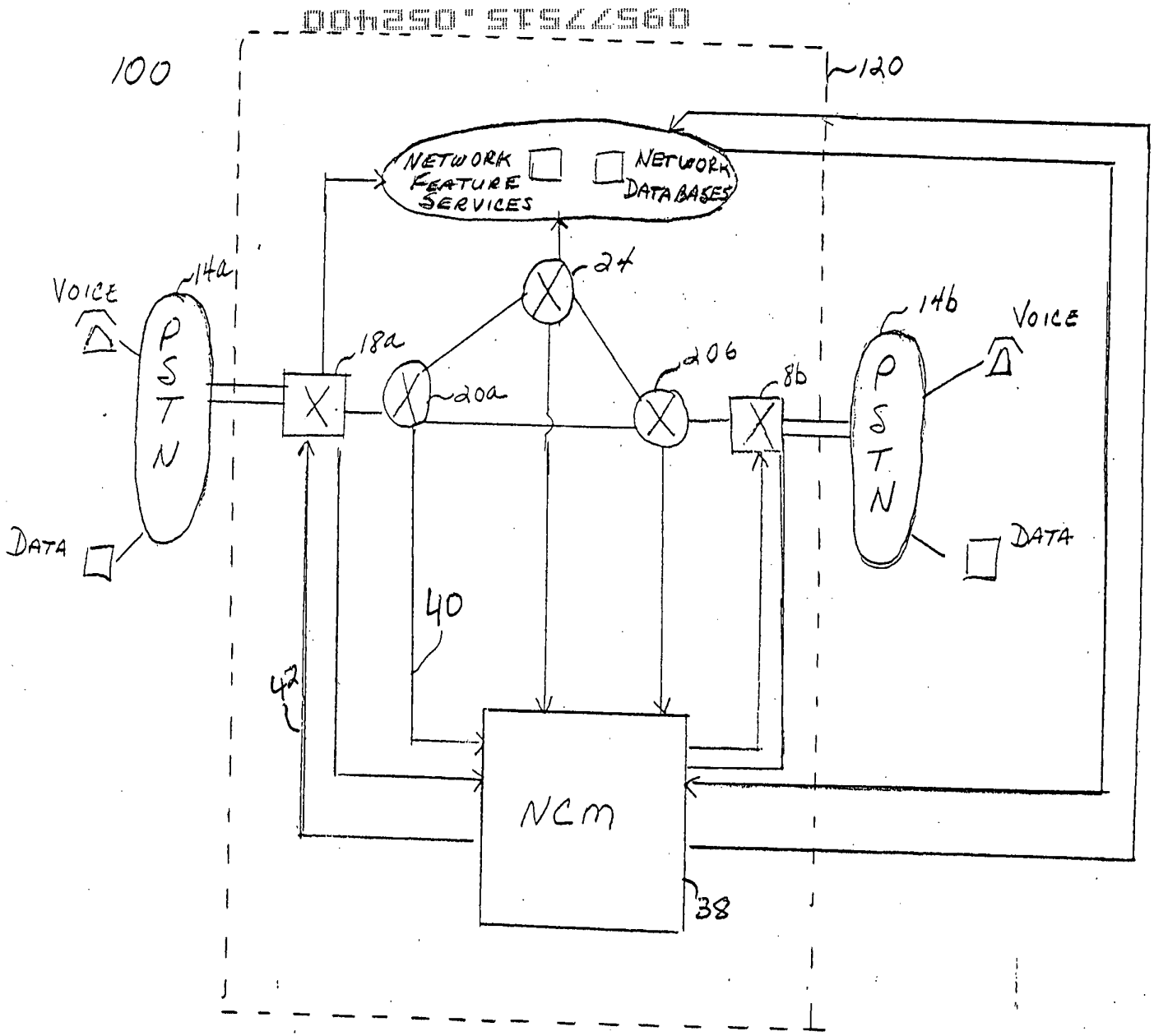

FIG. 2

Reconfiguration of Bandwidth Pipes (ATM)

N_i = Size of VTG_i in terms of DS_0 channels

λ_i = Call arrival rate at VTG_i

b_i = Fraction of blocked calls experienced at VTG_i

$(1/\mu)$ = Average holding time per call

T = Allowed blocking threshold

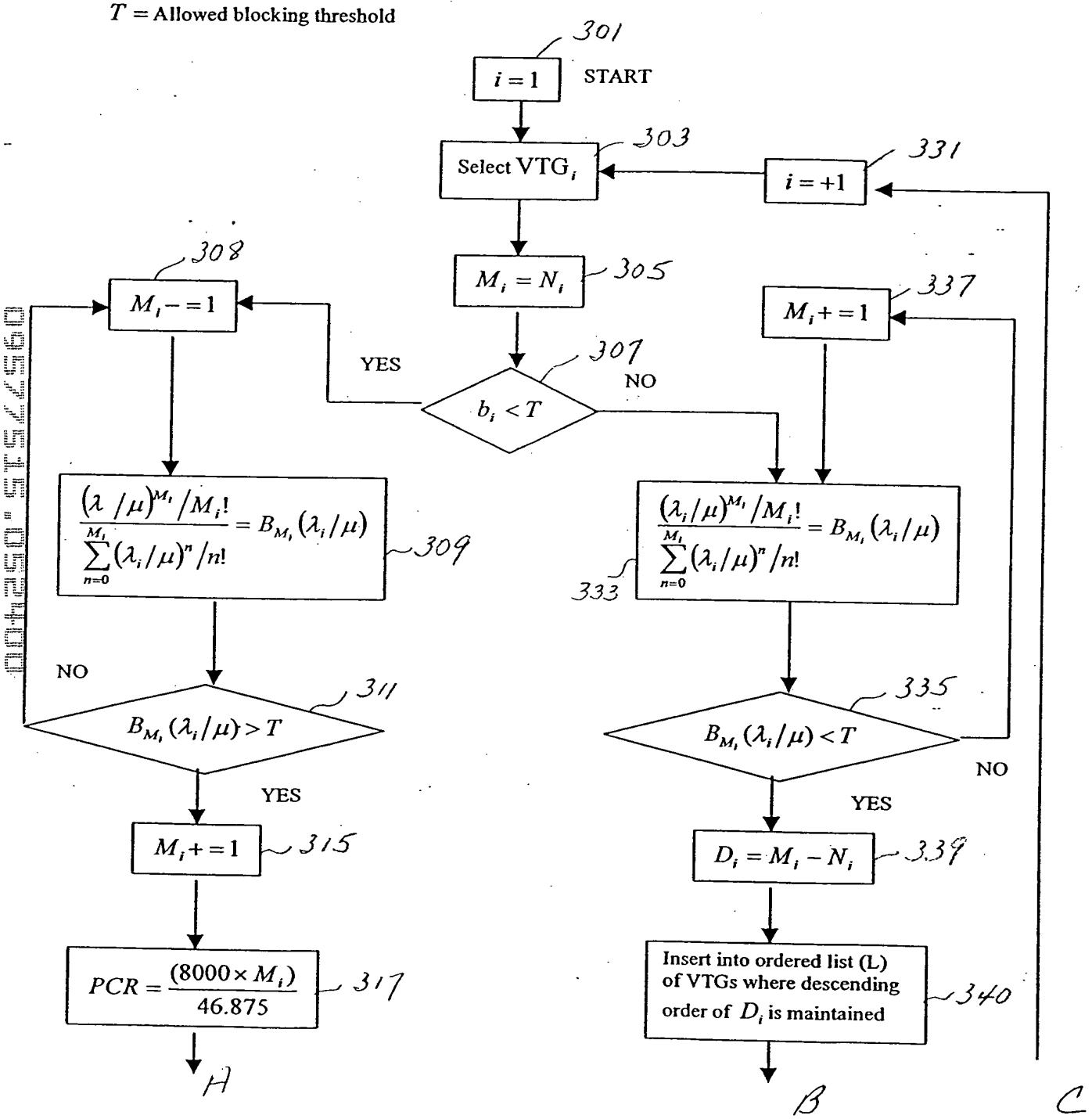

FIG. 3A

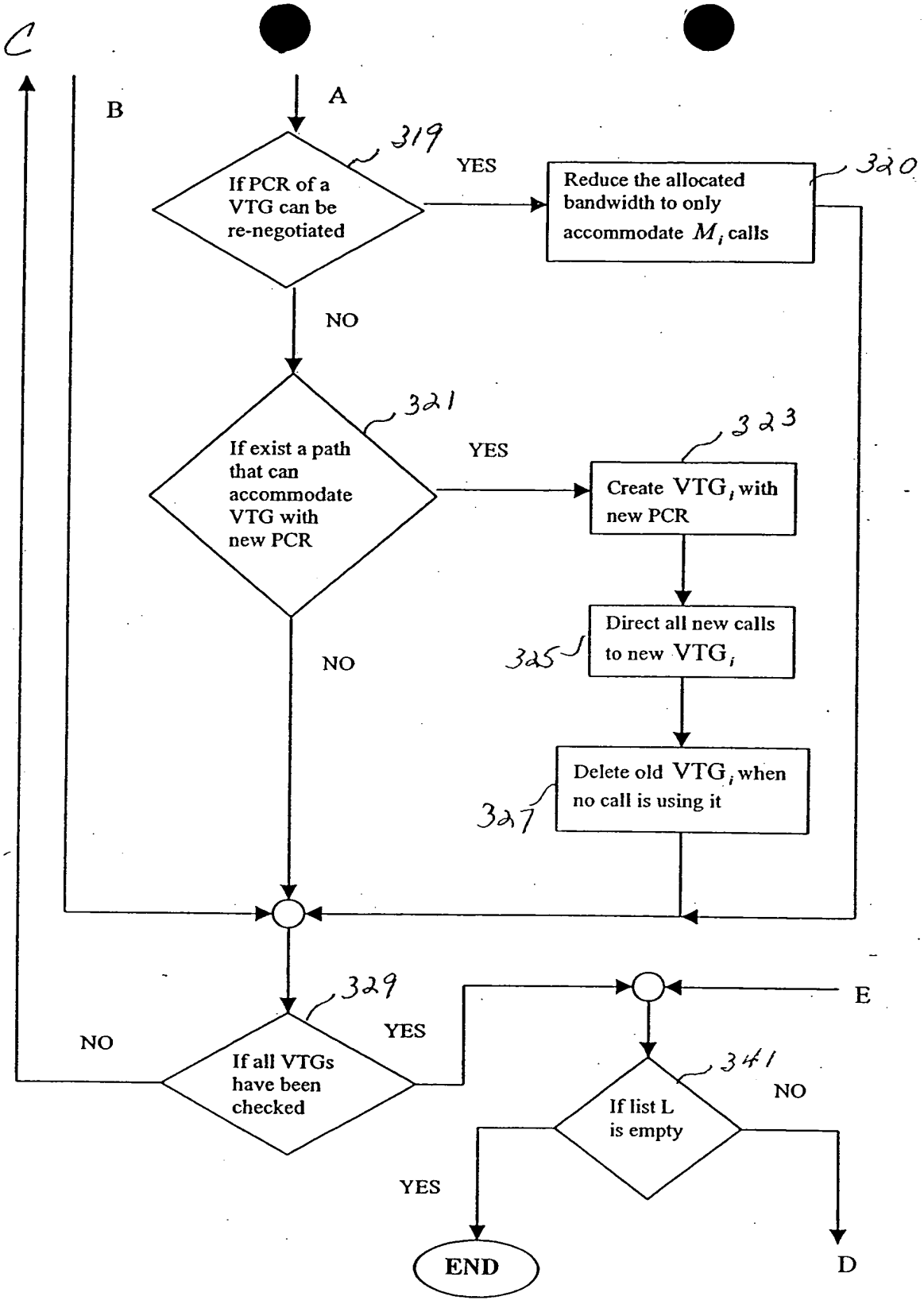
C
B
A
319
If PCR of a VTG can be re-negotiated
YES
Reduce the allocated bandwidth to only accommodate M_i calls
320
NO
321
If exist a path that can accommodate VTG with new PCR
YES
323
Create VTG_i with new PCR
Direct all new calls to new VTG_i
325
NO
Delete old VTG_i when no call is using it
327
329
YES
NO
If all VTGs have been checked
E
341
If list L is empty
NO
YES
END
D

FIG. 3B

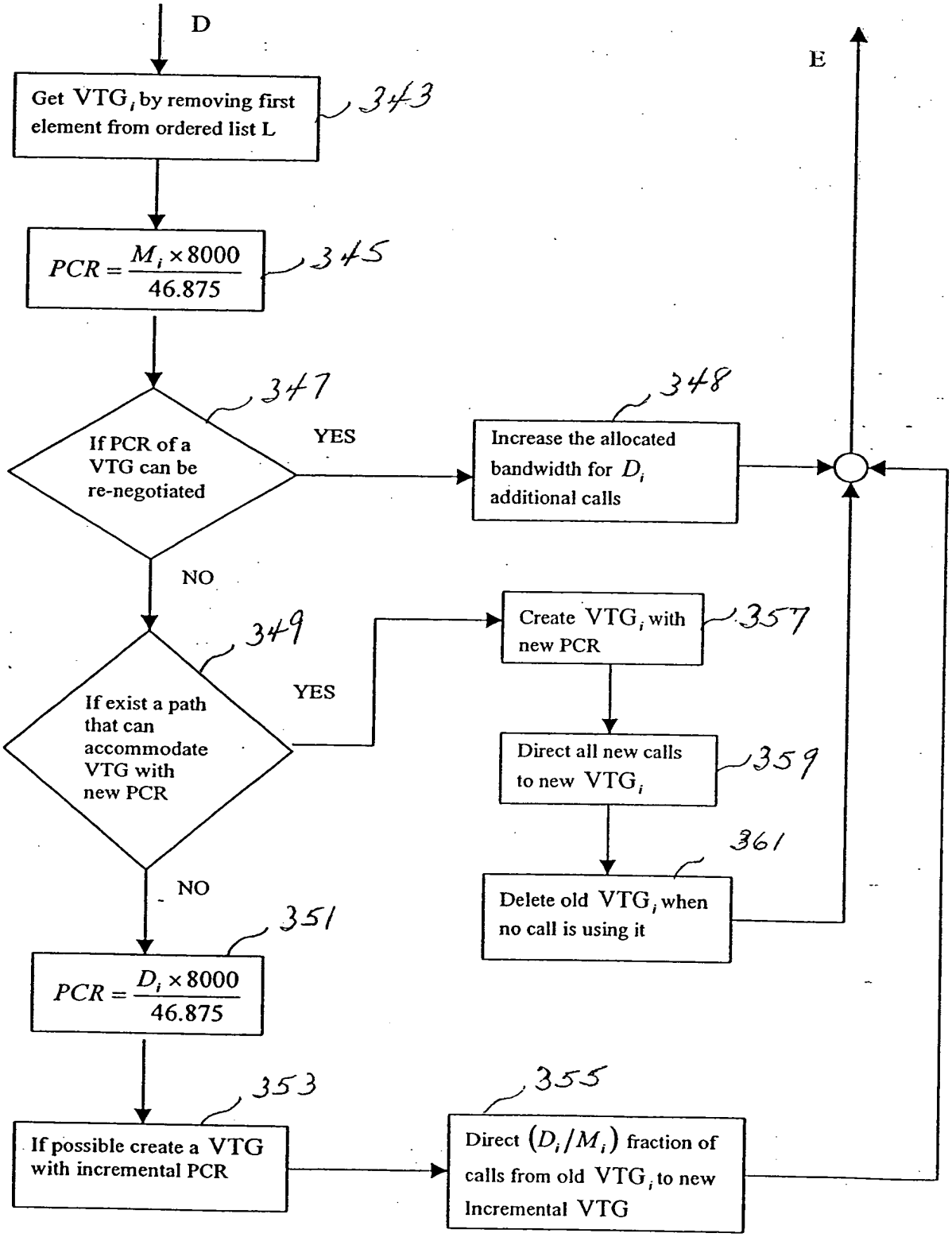
D
Get VTG_i by removing first element from ordered list L
343
$PCR = \frac{M_i \times 8000}{46.875}$
345
If PCR of a VTG can be re-negotiated
347
YES
Increase the allocated bandwidth for D_i additional calls
348
NO
If exist a path that can accommodate VTG with new PCR
349
YES
Create VTG_i with new PCR
357
Direct all new calls to new VTG_i
359
Delete old VTG_i when no call is using it
361
NO
$PCR = \frac{D_i \times 8000}{46.875}$
351
If possible create a VTG with incremental PCR
353
Direct (D_i/M_i) fraction of calls from old VTG_i to new Incremental VTG
355
E

FIG. 3C

Re-routing/Call Gapping of calls in PSTN Domain (ATM)

N_i = Size of VTG_i in terms of DS_0 channels

λ_i = Call arrival rate at VTG_i

b_i = Fraction of blocked calls experienced at VTG_i

$(1/\mu)$ = Average holding time per call

B_i = Fraction of blocked calls experienced at VTG_i

T = Allowed blocking threshold

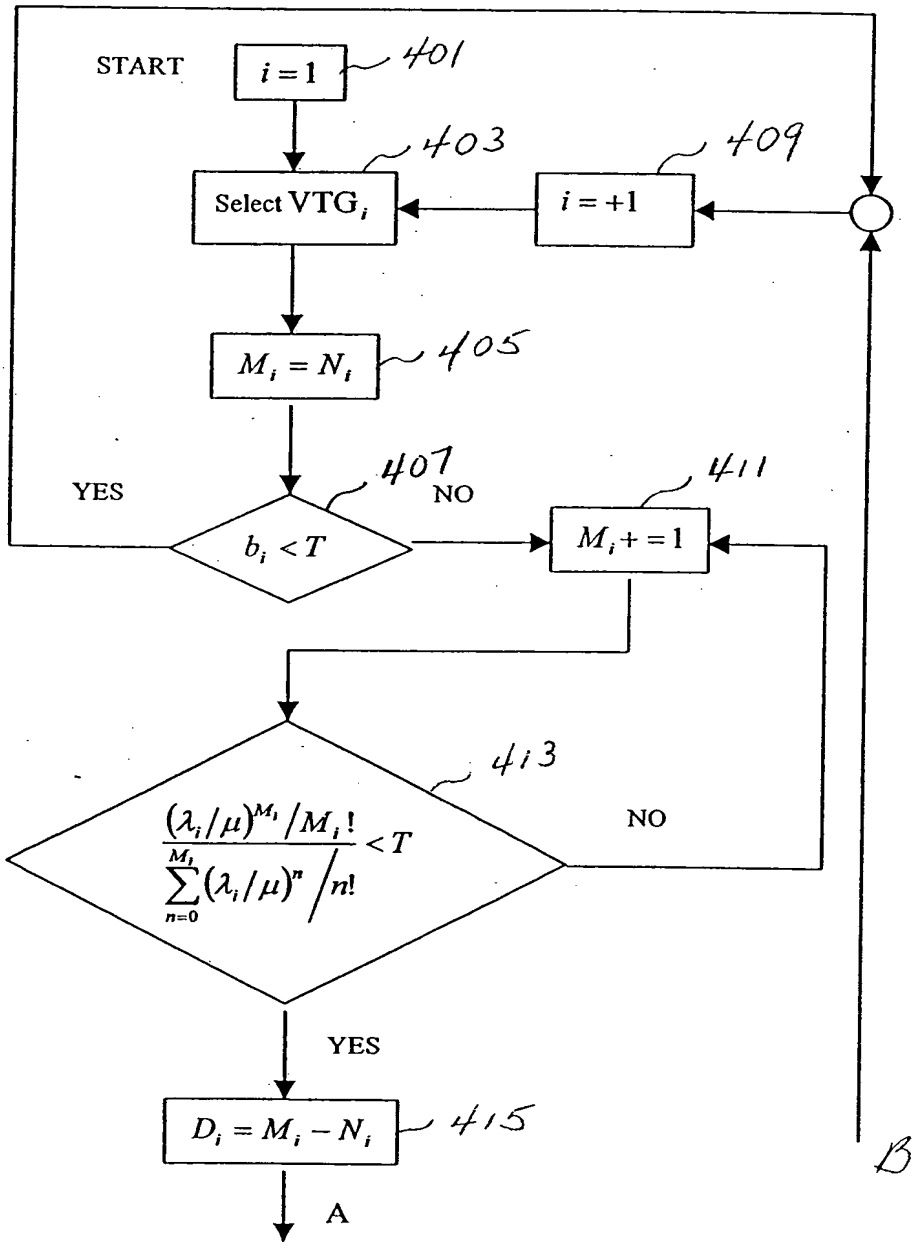

FIG. 4A

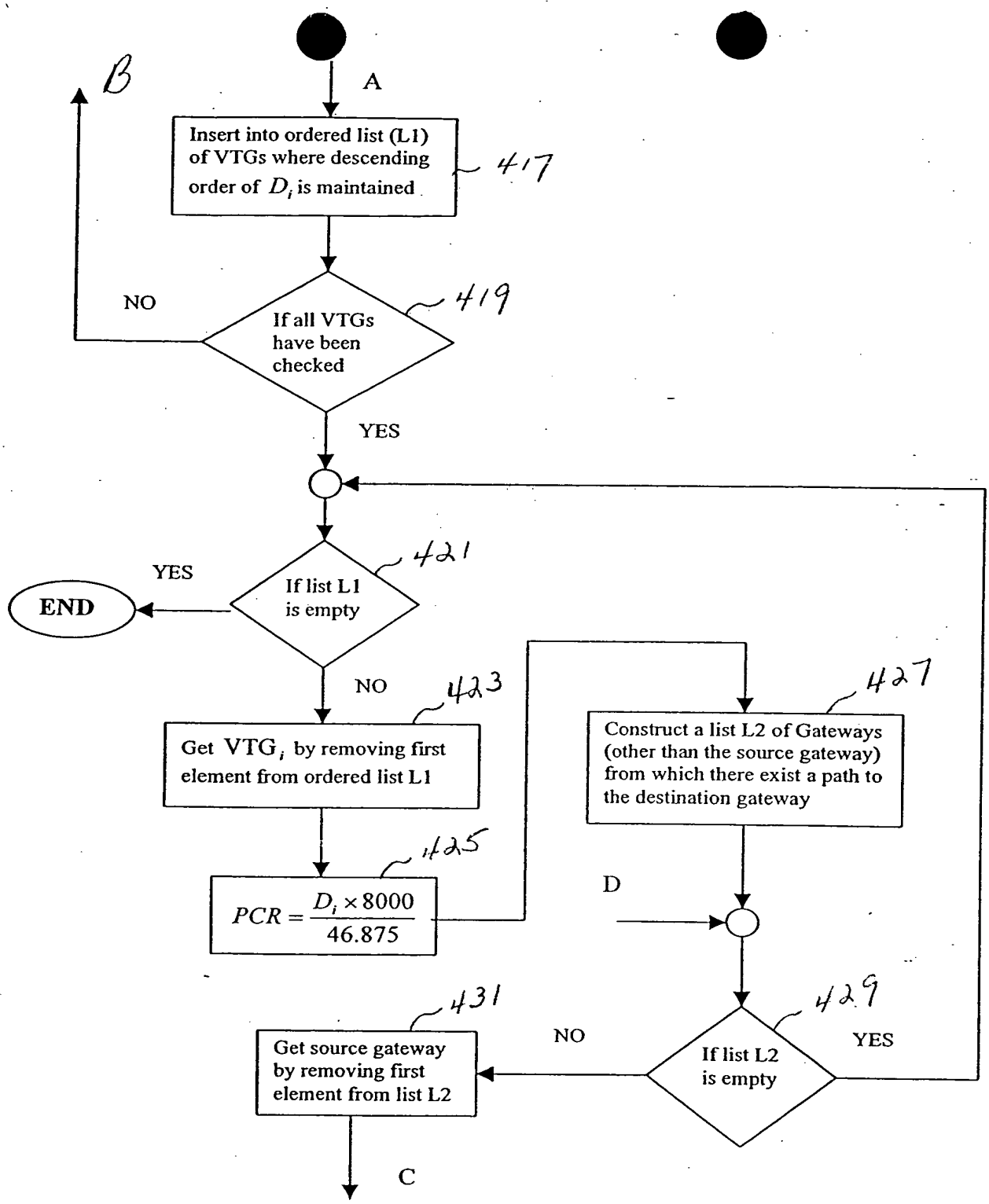
B
A
Insert into ordered list (L1) of VTGs where descending order of D_i is maintained
417
NO
If all VTGs have been checked
419
YES
YES
END
If list L1 is empty
421
NO
423
Get VTG_i by removing first element from ordered list L1
425
$PCR = \frac{D_i \times 8000}{46.875}$
427
Construct a list L2 of Gateways (other than the source gateway) from which there exist a path to the destination gateway
D
429
If list L2 is empty
NO
YES
431
Get source gateway by removing first element from list L2
C

FIG. 4B

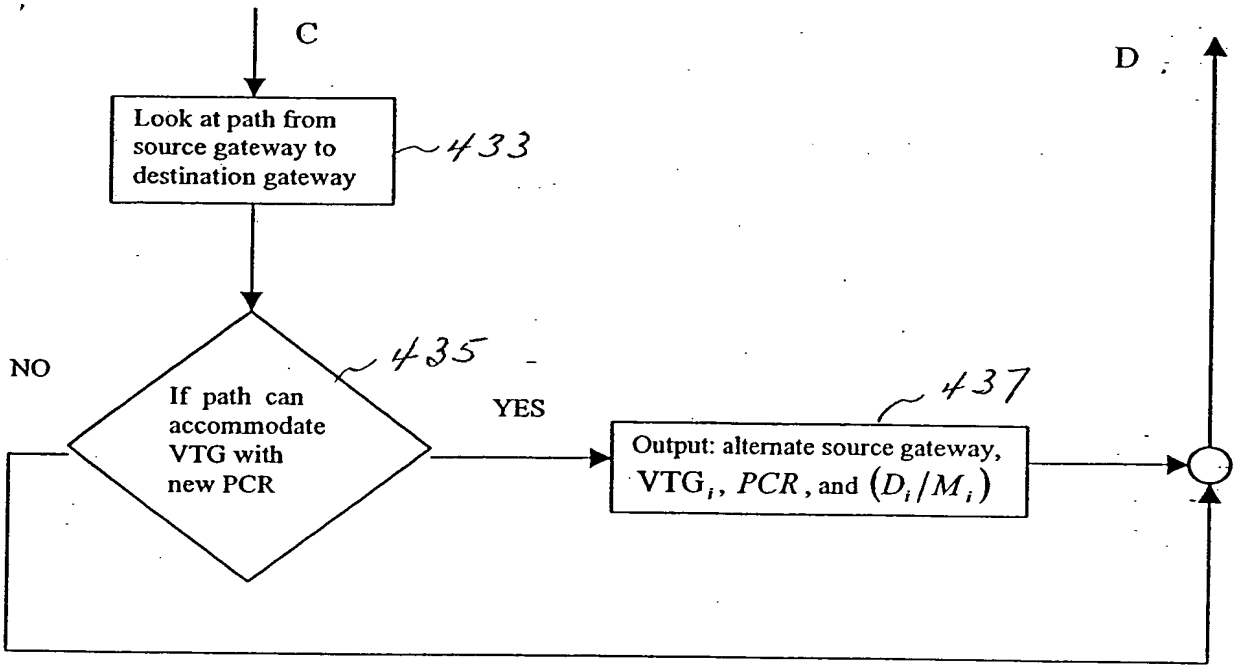
C
Look at path from source gateway to destination gateway
433
NO
If path can accommodate VTG with new PCR
435
YES
437
Output: alternate source gateway, VTG_i, PCR, and (D_i/M_i)
D

FIG. 4C

Voice Compression (ATM)

N_i = Size of VTG_i in terms of DS_0 channels

λ_i = Call arrival rate at VTG_i

b_i = Fraction of blocked calls experienced at VTG_i

CCR_i = current compression rate allocated to VTG_i

$(1/\mu)$ = Average holding time per call

T = Allowed blocking threshold

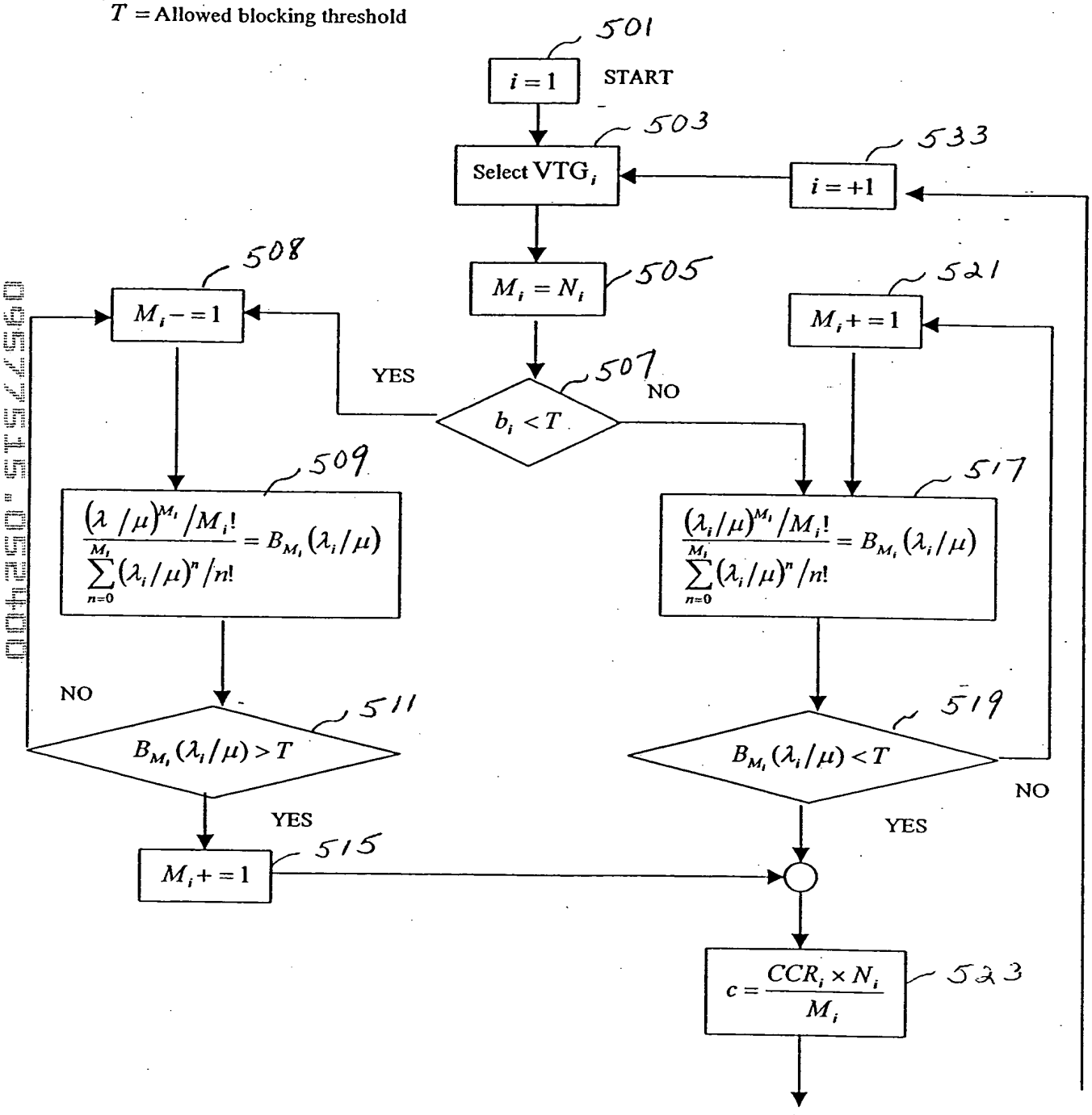

FIG. 5A

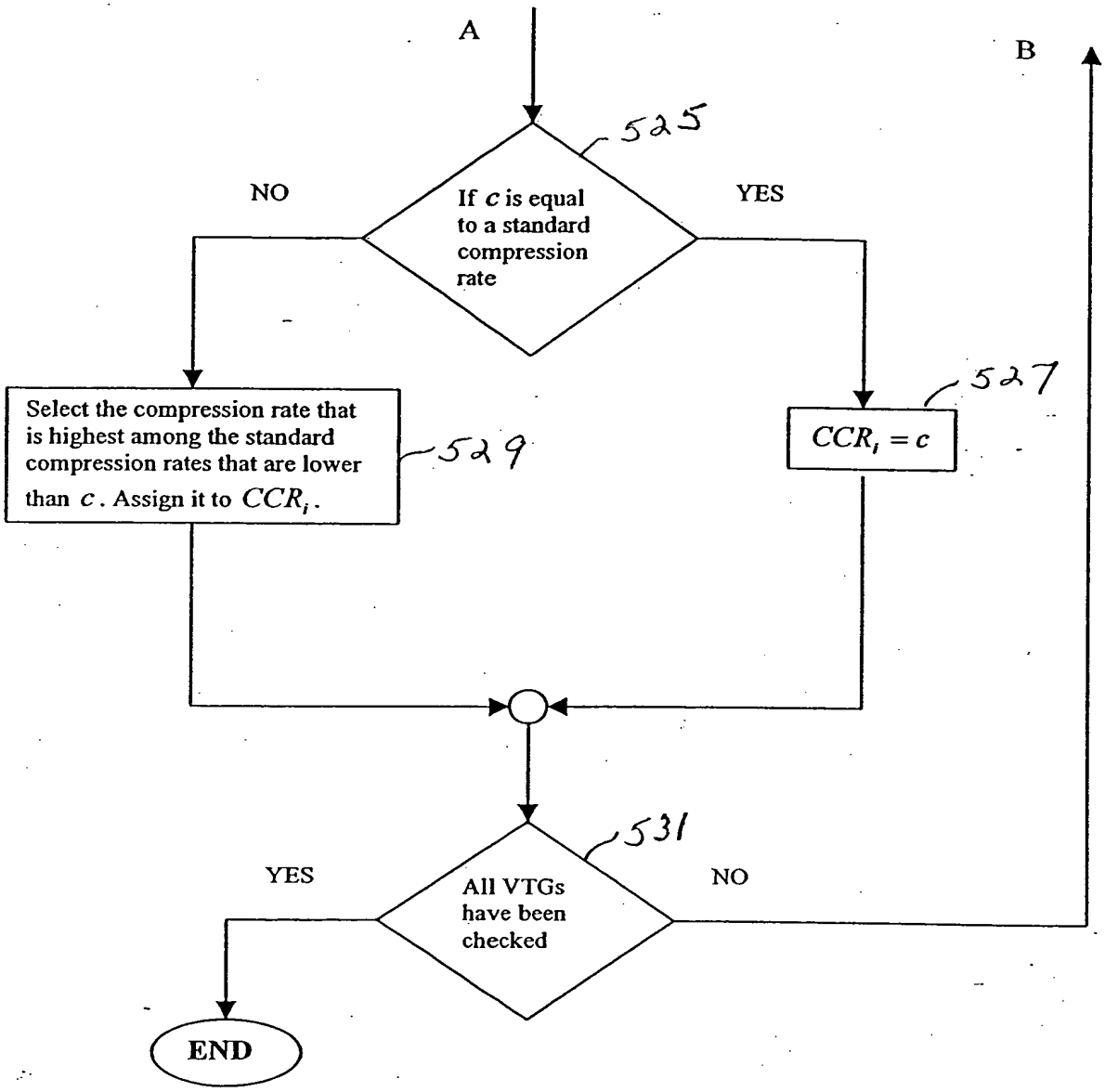
A
B
525
If c is equal to a standard compression rate
NO
YES
Select the compression rate that is highest among the standard compression rates that are lower than c. Assign it to CCR_i.
529
$CCR_i = c$
527
531
All VTGs have been checked
YES
NO
END

FIG. 5B

Call Blocking (unavailability of RTP measurements)

PU_i = utilization of i^{th} port

PC_i = capacity of i^{th} port

U_t = utilization threshold

λ_k = call arrival rate for k^{th} PVG pair

N_k = number of calls for which bandwidth is allocated to k^{th} PVG pair

p_{B_i} = bandwidth reduction correction factor due to the i^{th} port

p_{G_i} = bandwidth incremental correction factor due to the i^{th} port

f_k = bandwidth reduction correction factor assigned to the k^{th} PVG pair

e_k = bandwidth incremental correction factor assigned to the k^{th} PVG pair

B_k = assigned blocking probability to the k^{th} PVG pair

$(1/\mu)$ = average call holding time

T = blocking threshold

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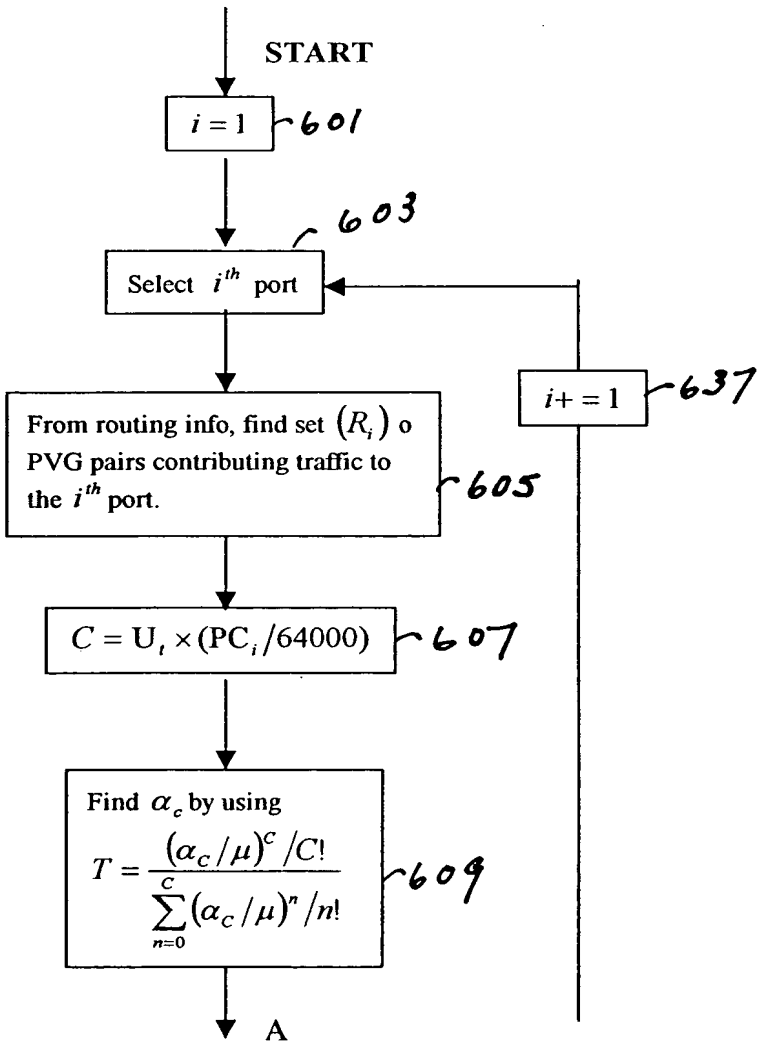

FIG 6A

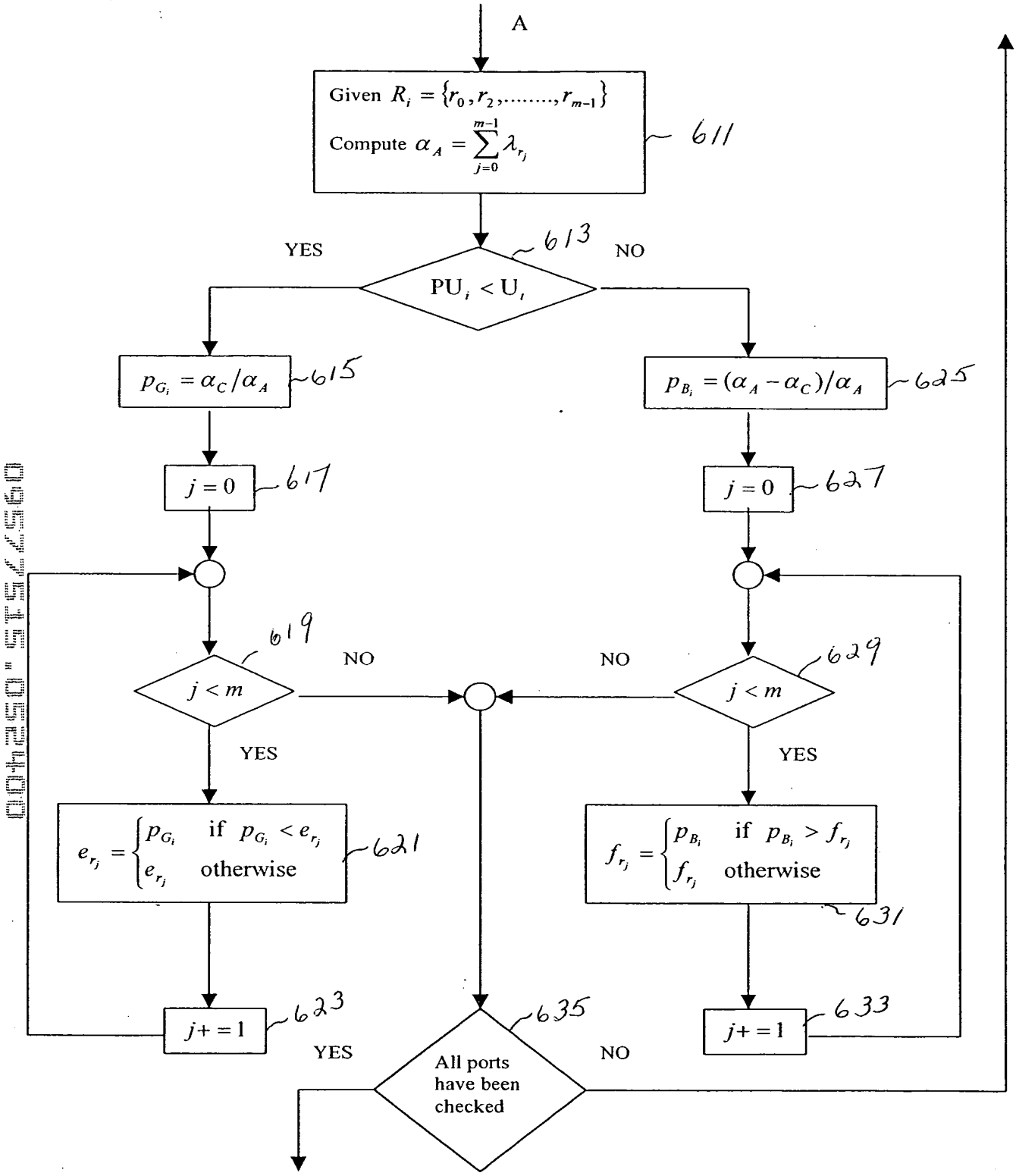
A
Given $R_i = \{r_0, r_2, \ldots\ldots, r_{m-1}\}$
Compute $\alpha_A = \sum_{j=0}^{m-1} \lambda_{r_j}$
611
YES
613
NO
$PU_i < U_t$
$p_{G_i} = \alpha_C / \alpha_A$
615
$p_{B_i} = (\alpha_A - \alpha_C)/\alpha_A$
625
$j = 0$
617
$j = 0$
627
619
NO
NO
629
$j < m$
$j < m$
YES
YES
$e_{r_j} = \begin{cases} p_{G_i} & \text{if } p_{G_i} < e_{r_j} \\ e_{r_j} & \text{otherwise} \end{cases}$
621
$f_{r_j} = \begin{cases} p_{B_i} & \text{if } p_{B_i} > f_{r_j} \\ f_{r_j} & \text{otherwise} \end{cases}$
631
$j+=1$
623
$j+=1$
633
YES
635
NO
All ports have been checked

FIG. 6B

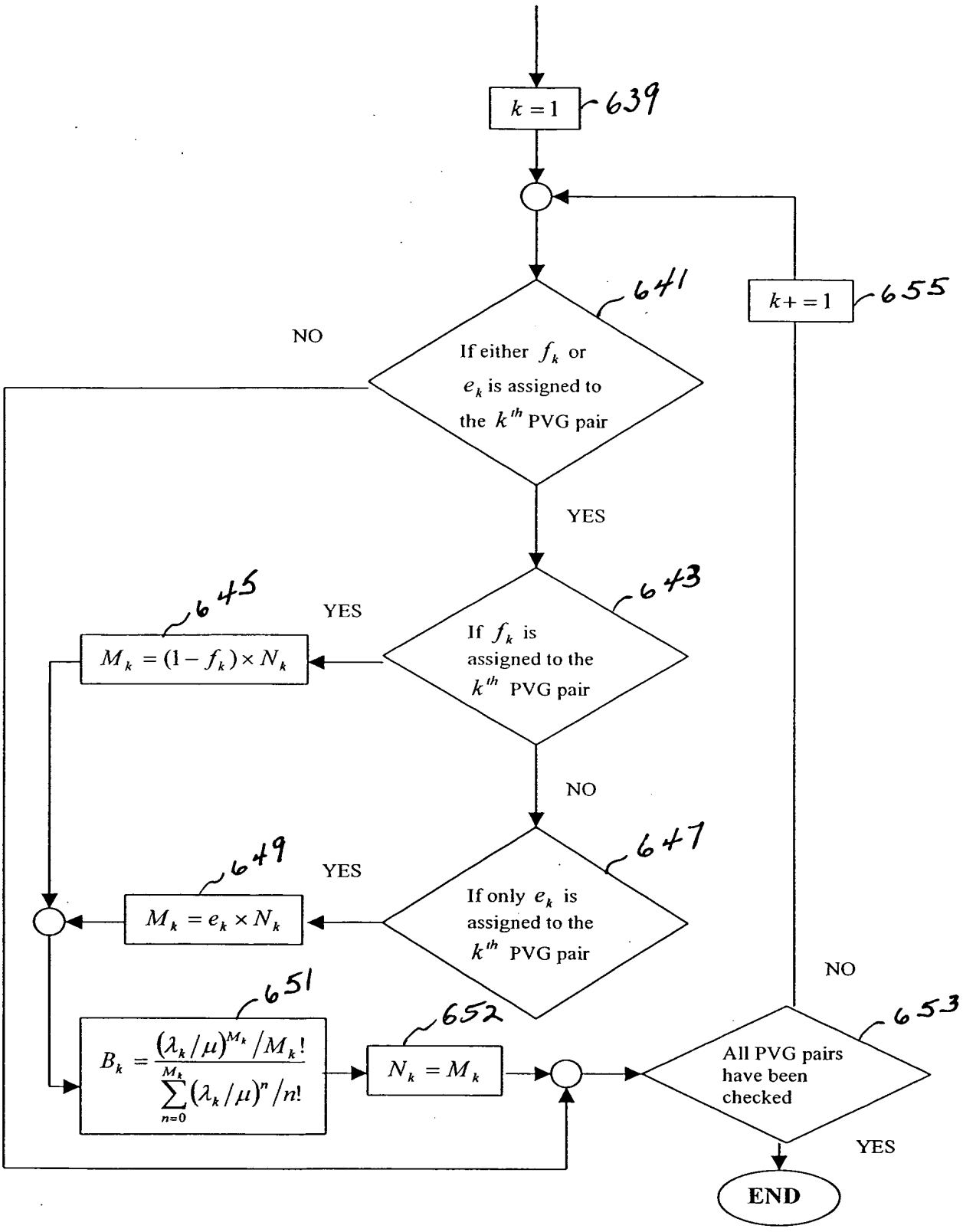
$k = 1$
639
641
If either f_k or e_k is assigned to the k^{th} PVG pair
NO
YES
643
If f_k is assigned to the k^{th} PVG pair
YES
645
$M_k = (1 - f_k) \times N_k$
NO
647
If only e_k is assigned to the k^{th} PVG pair
YES
649
$M_k = e_k \times N_k$
651
$B_k = \frac{(\lambda_k/\mu)^{M_k}/M_k!}{\sum_{n=0}^{M_k}(\lambda_k/\mu)^n/n!}$
652
$N_k = M_k$
$k+ = 1$
655
NO
653
All PVG pairs have been checked
YES
END

FIG. 6C

Call Blocking (Availability of RTP measurements)

L_C = fraction of packet loss per call

L_t = packet loss threshold

D_C = delay jitter per call

D_t = delay jitter threshold

N_i = number of active calls in i^{th} PVG pair

PVGPAIR_i = i^{th} PVG pair

S = set of PVG pairs between which poor performing calls exist

P = set of all PVG pairs

F_i = indicator flag for PVGPAIR_i

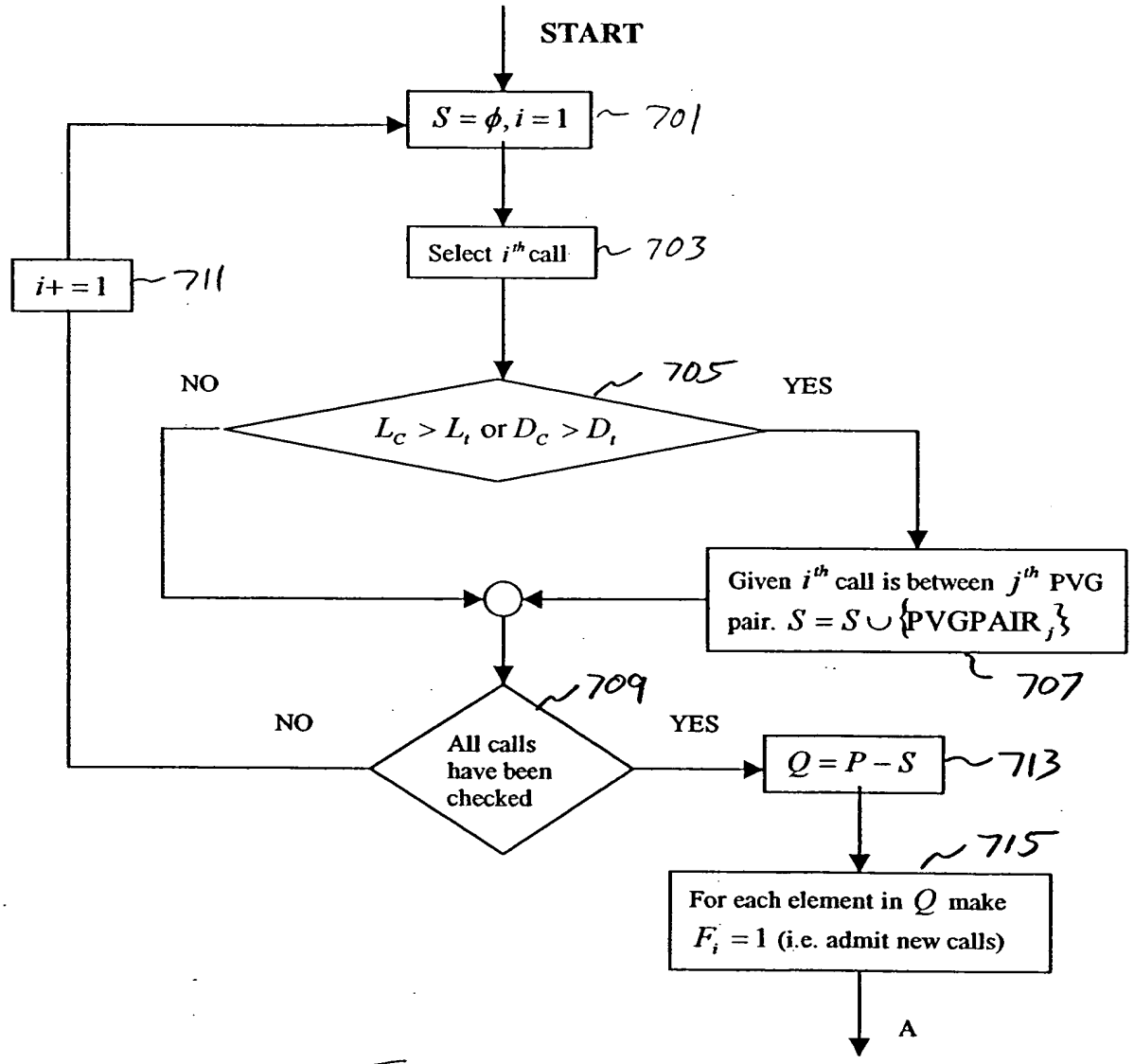

Fig. 7A

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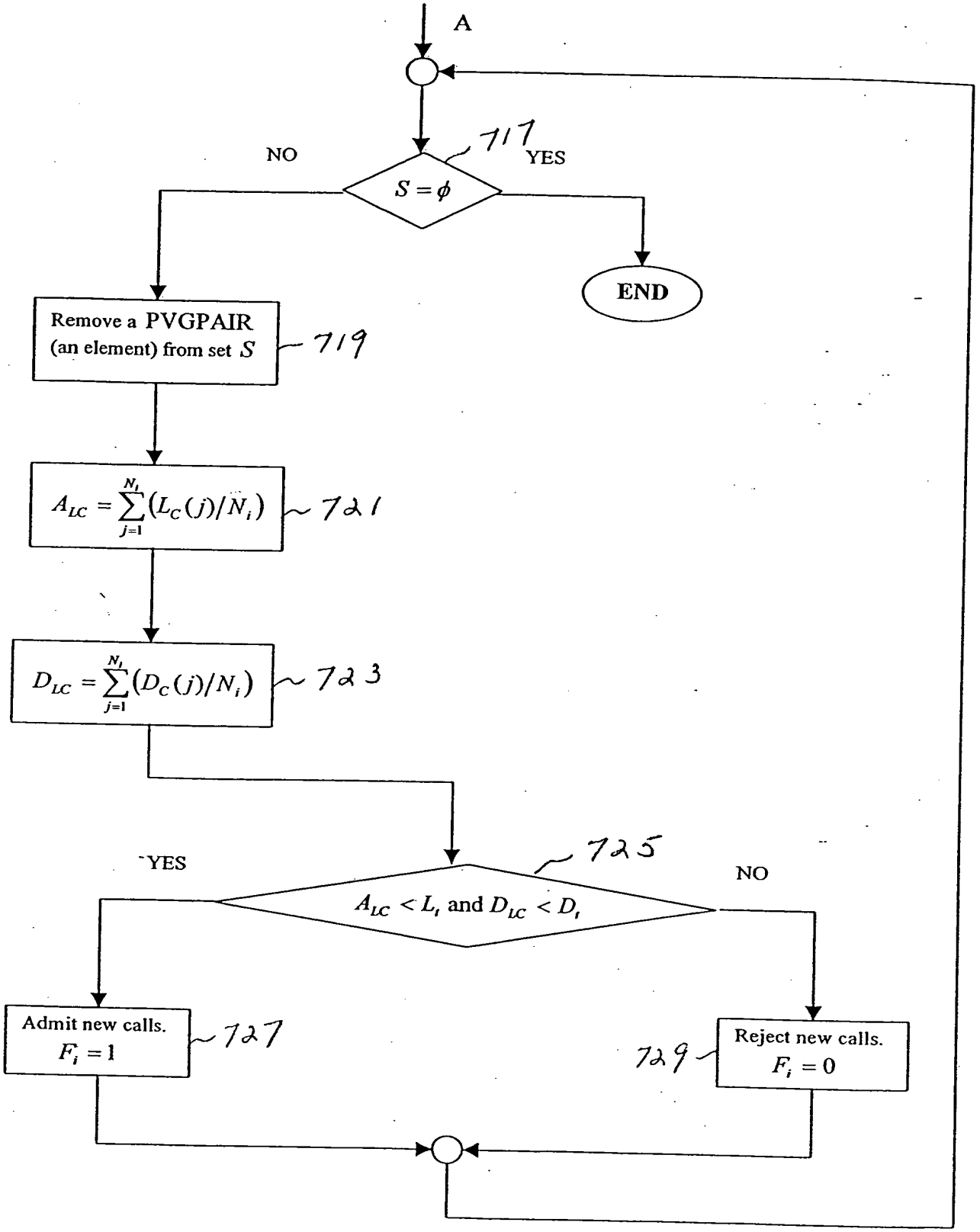
A
717
NO
YES
$S = \phi$
END
Remove a PVGPAIR (an element) from set S
719
$A_{LC} = \sum_{j=1}^{N_i} (L_C(j)/N_i)$
721
$D_{LC} = \sum_{j=1}^{N_i} (D_C(j)/N_i)$
723
725
YES
NO
$A_{LC} < L_i$ and $D_{LC} < D_i$
Admit new calls. $F_i = 1$
727
729
Reject new calls. $F_i = 0$

FIG. 7B

Re-routing/Call Gapping (Availability/unavailability of RTP measurements)

PU_i = utilization of i^{th} port

PC_i = capacity of i^{th} port

U_t = utilization threshold

λ_k = call arrival rate for k^{th} PVG pair

N_k = number of calls for which bandwidth is allocated to k^{th} PVG pair

$(1/\mu)$ = average call holding time

p_{B_i} = bandwidth correction factor due to i^{th} port

f_k = bandwidth correction factor assigned to the k^{th} PVG pair

T = blocking threshold

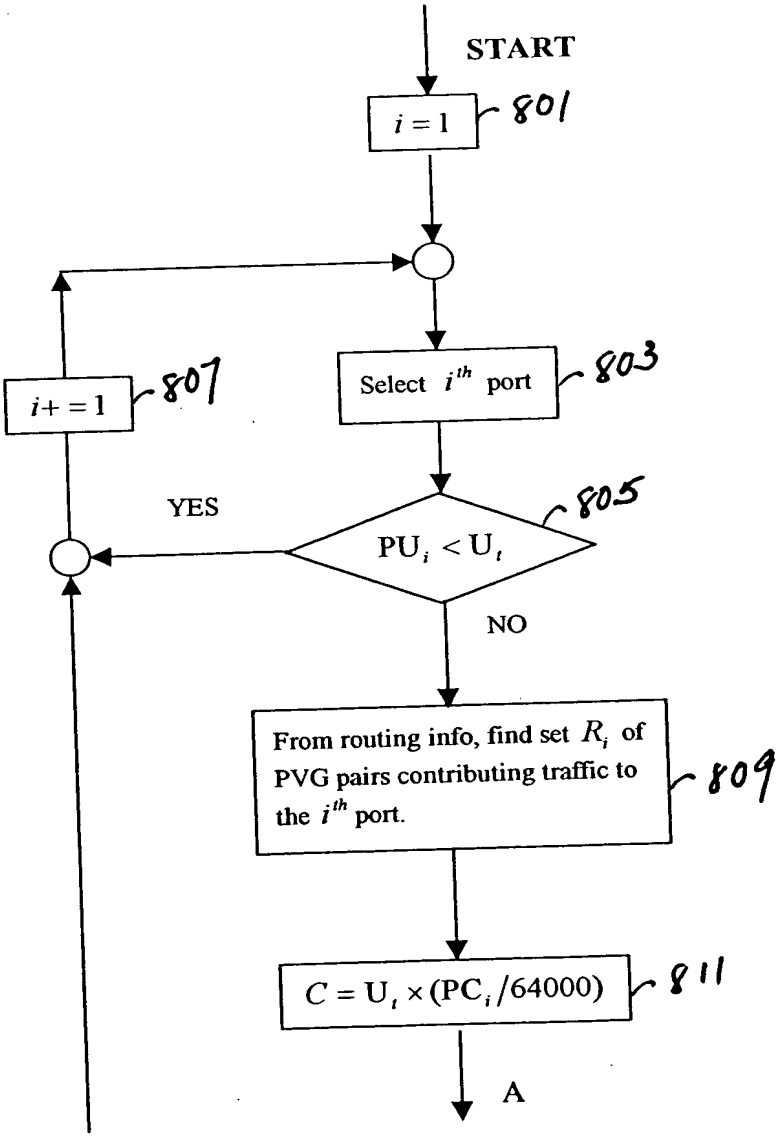

FIG. 8A

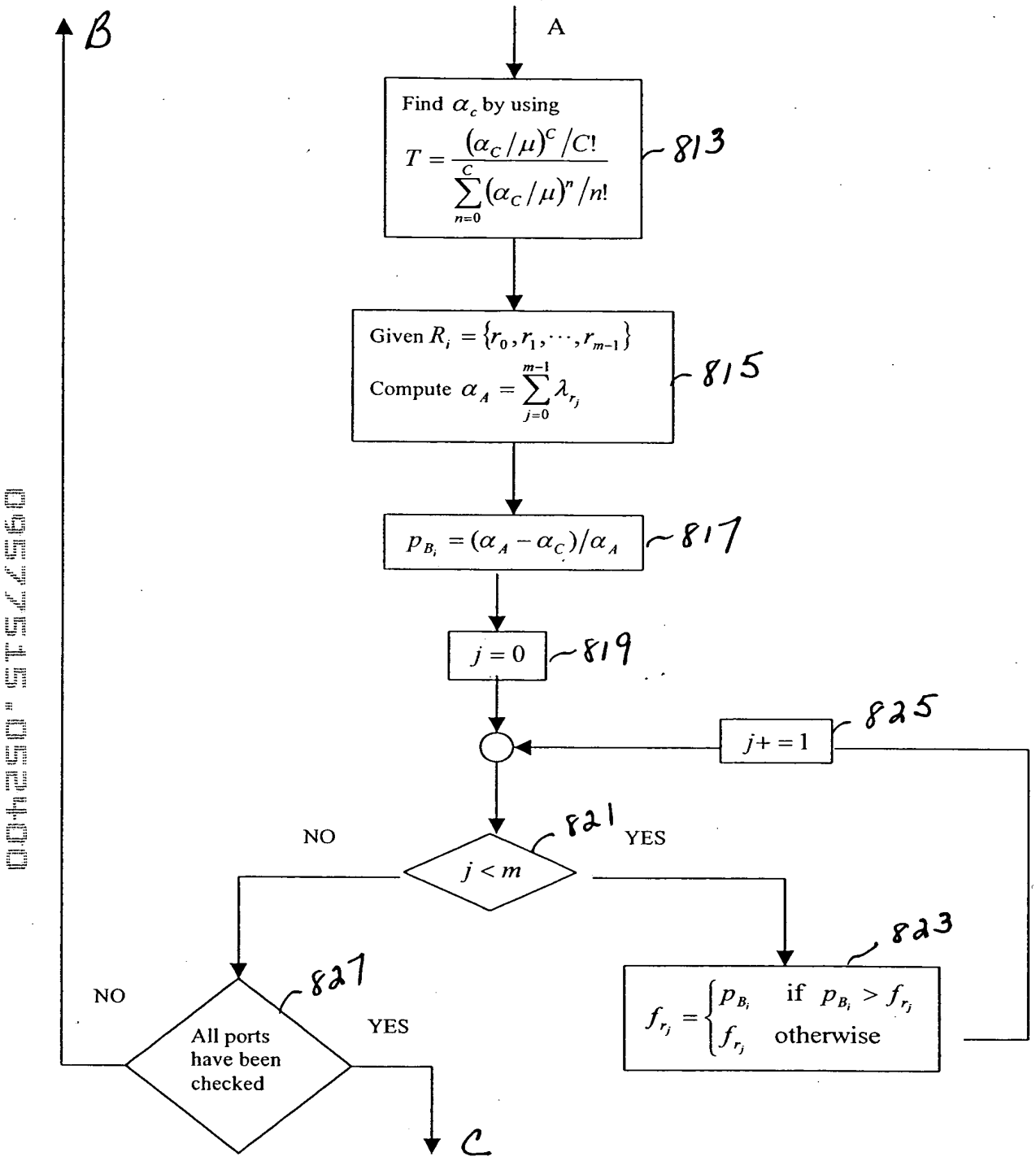
B
A
Find α_c by using
$T = \frac{(\alpha_C/\mu)^C/C!}{\sum_{n=0}^{C}(\alpha_C/\mu)^n/n!}$
813
Given $R_i = \{r_0, r_1, \cdots, r_{m-1}\}$
Compute $\alpha_A = \sum_{j=0}^{m-1}\lambda_{r_j}$
815
$p_{B_i} = (\alpha_A - \alpha_C)/\alpha_A$
817
$j = 0$
819
$j+=1$
825
NO
821
YES
$j < m$
823
$f_{r_j} = \begin{cases} p_{B_i} & \text{if } p_{B_i} > f_{r_j} \\ f_{r_j} & \text{otherwise} \end{cases}$
NO
827
All ports have been checked
YES
C

FIG. 8B

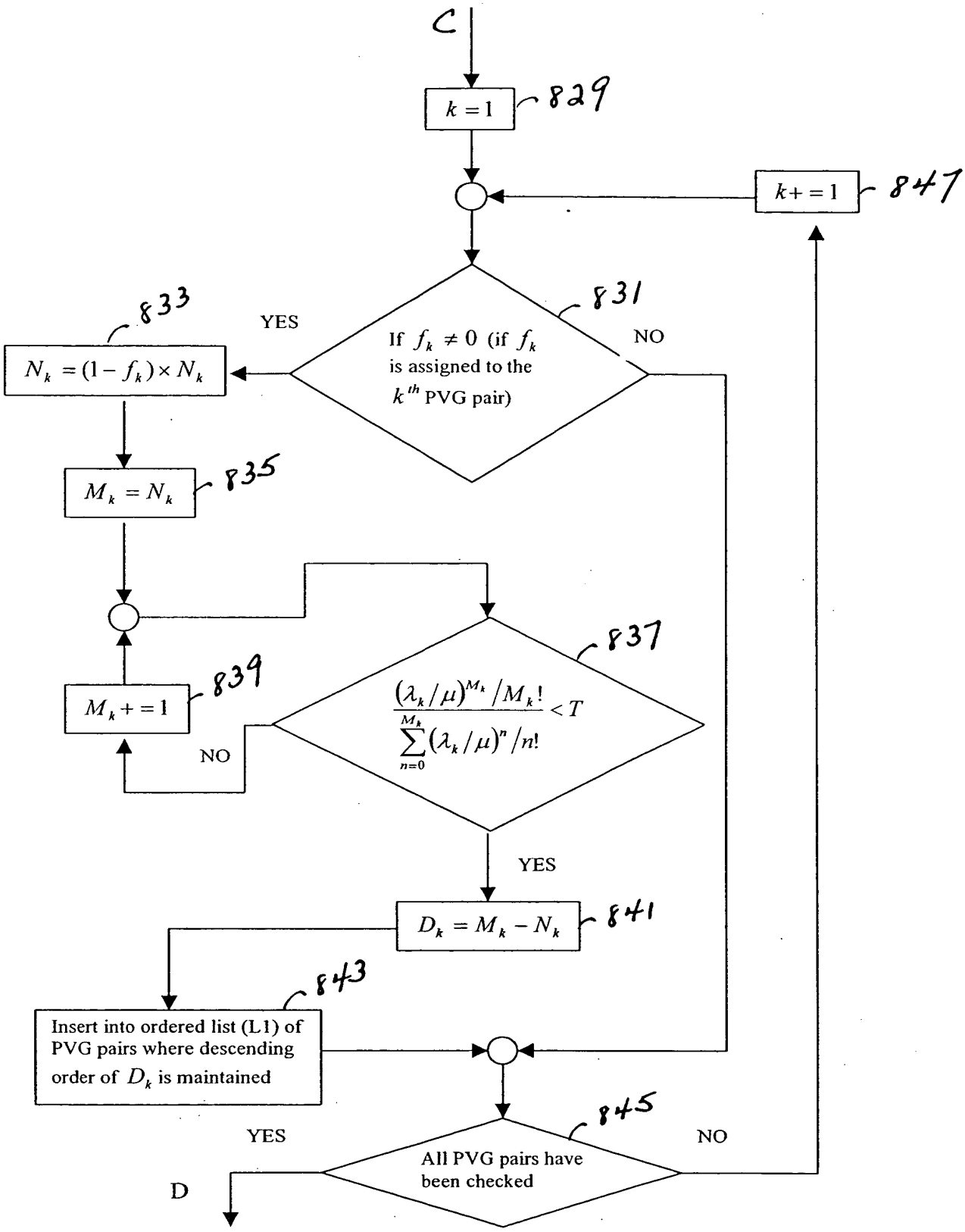
C
$k=1$
829
$k+=1$
847
If $f_k \neq 0$ (if f_k is assigned to the k^{th} PVG pair)
831
YES
NO
833
$N_k = (1-f_k) \times N_k$
$M_k = N_k$
835
$M_k+=1$
839
NO
$\frac{(\lambda_k/\mu)^{M_k}/M_k!}{\sum_{n=0}^{M_k}(\lambda_k/\mu)^n/n!} < T$
837
YES
$D_k = M_k - N_k$
841
Insert into ordered list (L1) of PVG pairs where descending order of D_k is maintained
843
YES
All PVG pairs have been checked
845
NO
D

FIG. 8C

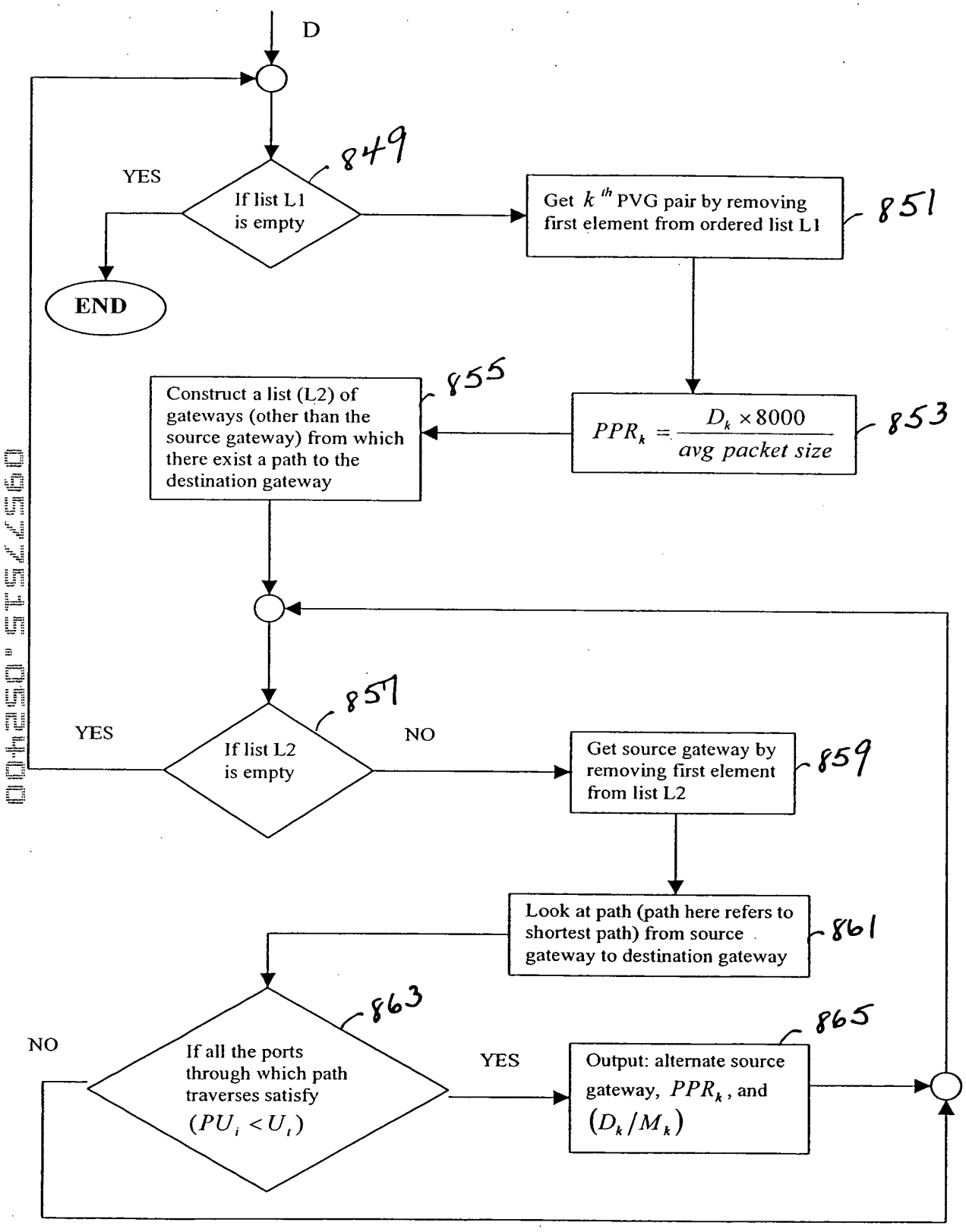
D
849
YES
If list L1 is empty
END
Get k^{th} PVG pair by removing first element from ordered list L1
851
$PPR_k = \frac{D_k \times 8000}{avg\ packet\ size}$
853
Construct a list (L2) of gateways (other than the source gateway) from which there exist a path to the destination gateway
855
YES
If list L2 is empty
857
NO
Get source gateway by removing first element from list L2
859
Look at path (path here refers to shortest path) from source gateway to destination gateway
861
NO
If all the ports through which path traverses satisfy $(PU_i < U_t)$
863
YES
Output: alternate source gateway, PPR_k, and (D_k/M_k)
865

FIG. 8D

Compression (Availability/unavailability of RTP measurements)

U_i = utilization of i^{th} port

PC_i = capacity of i^{th} port

U_t = utilization threshold

λ_k = call arrival rate for k^{th} PVG pair

N_k = number of calls for which bandwidth is allocated to k^{th} PVG pair

CCR_k = current compression rate allocated to k^{th} PVG pair

p_{B_i} = bandwidth reduction factor due to the i^{th} port

p_{G_i} = bandwidth incremental factor due to the i^{th} port

f_k = bandwidth reduction correction factor assigned to the k^{th} PVG pair

e_k = bandwidth incremental correction factor assigned to the k^{th} PVG pair

$(1/\mu)$ = average call holding time

T = blocking threshold

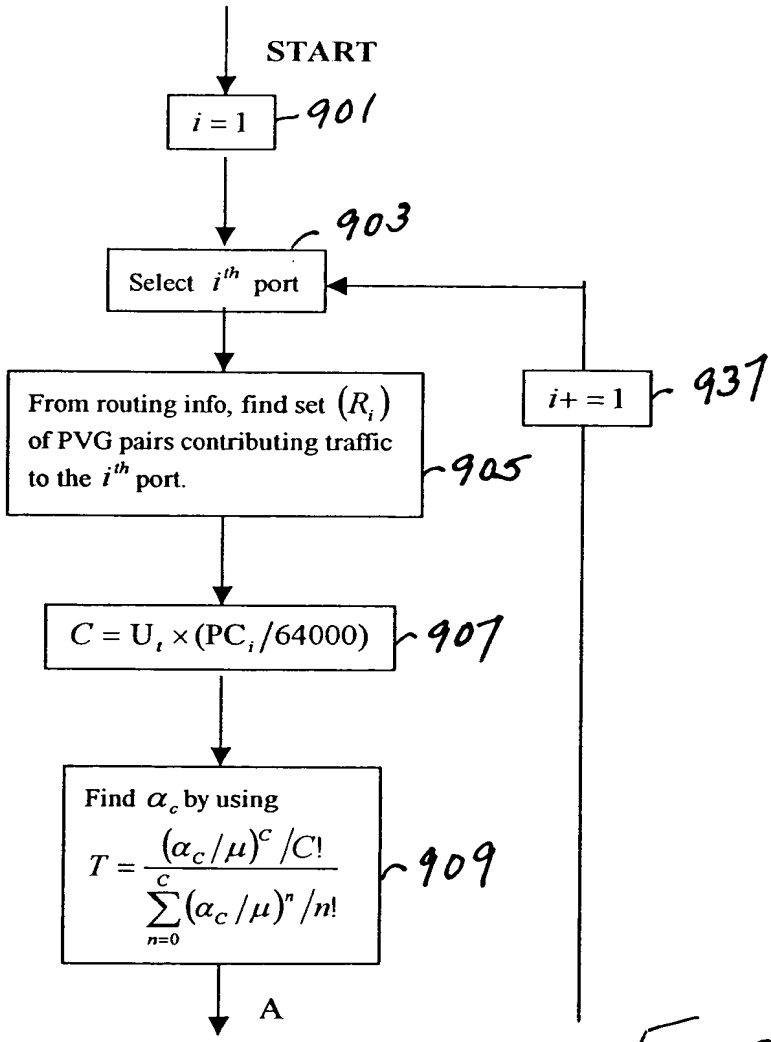

FIG. 9A

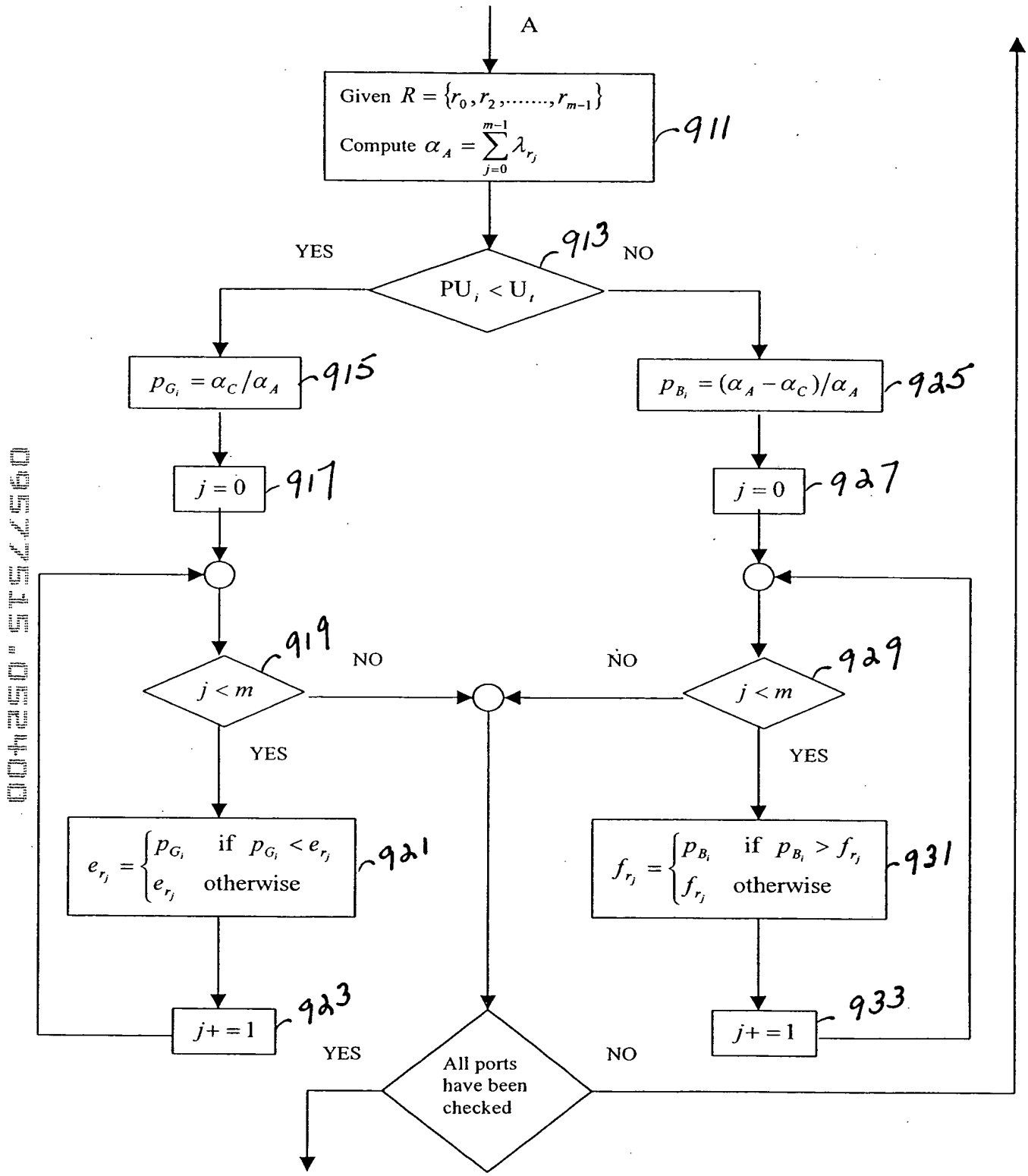
A
Given $R = \{r_0, r_2, \ldots\ldots, r_{m-1}\}$
Compute $\alpha_A = \sum_{j=0}^{m-1} \lambda_{r_j}$
911
YES
913
NO
$PU_i < U_t$
$p_{G_i} = \alpha_C / \alpha_A$
915
$p_{B_i} = (\alpha_A - \alpha_C)/\alpha_A$
925
$j = 0$
917
$j = 0$
927
919
NO
NO
929
$j < m$
$j < m$
YES
YES
$e_{r_j} = \begin{cases} p_{G_i} & \text{if } p_{G_i} < e_{r_j} \\ e_{r_j} & \text{otherwise} \end{cases}$
921
$f_{r_j} = \begin{cases} p_{B_i} & \text{if } p_{B_i} > f_{r_j} \\ f_{r_j} & \text{otherwise} \end{cases}$
931
$j+=1$
923
$j+=1$
933
YES
NO
All ports have been checked

FIG. 9B

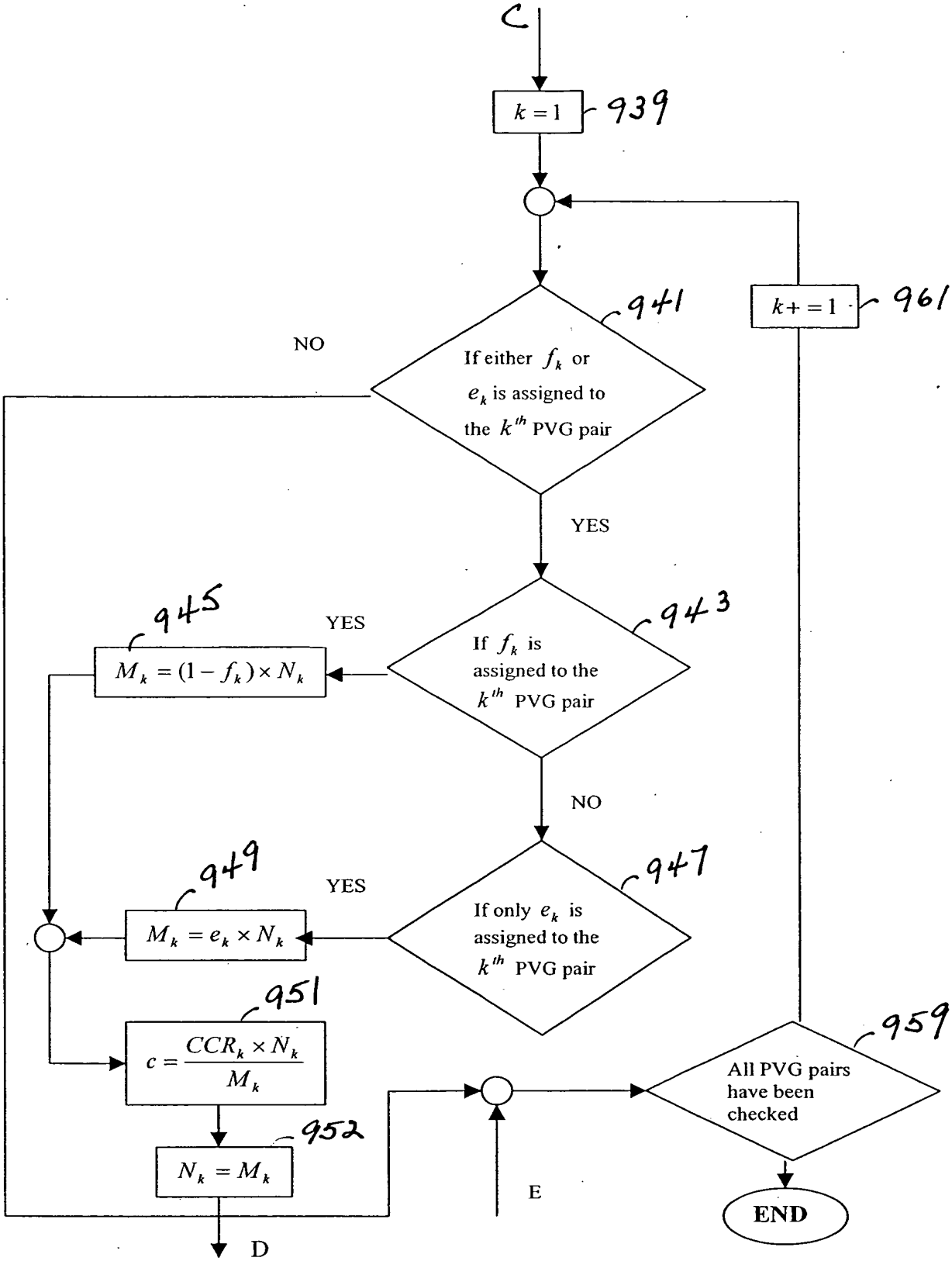
C
$k=1$
939
941
If either f_k or e_k is assigned to the k^{th} PVG pair
NO
YES
961
$k+=1$
943
If f_k is assigned to the k^{th} PVG pair
YES
945
$M_k=(1-f_k)\times N_k$
NO
947
If only e_k is assigned to the k^{th} PVG pair
YES
949
$M_k=e_k\times N_k$
951
$c=\frac{CCR_k\times N_k}{M_k}$
952
$N_k=M_k$
D
E
959
All PVG pairs have been checked
END

FIG. 9C

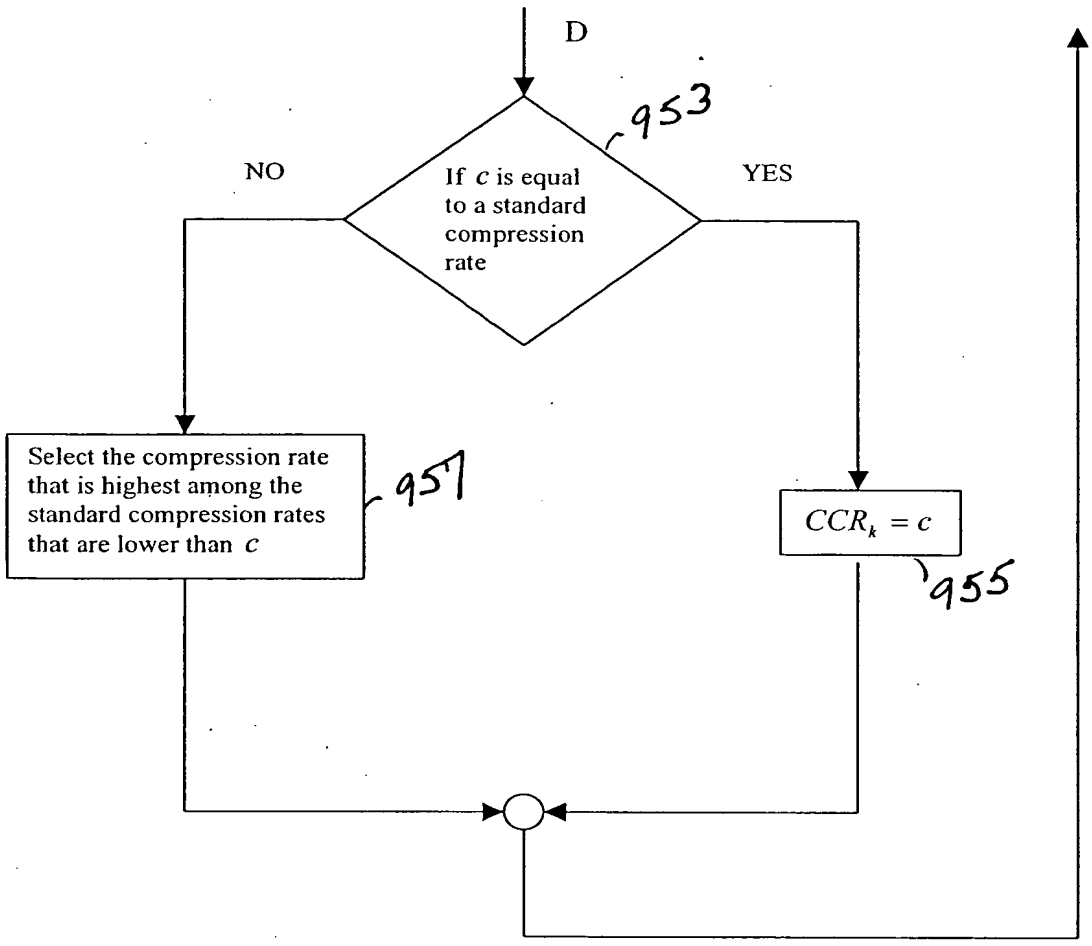
D
953
If c is equal to a standard compression rate
NO
YES
Select the compression rate that is highest among the standard compression rates that are lower than c
957
$CCR_k = c$
955

FIG. 9D